

IN THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of claims:

1-9. (Cancelled)

10. (Previously presented) An apparatus comprising:

a package substrate including a thermally conductive substrate core, having first and second portions, and a buildup layer, including a plurality of conductive traces and vias formed therein interconnecting top and bottom surfaces of the buildup layer, being disposed on only the first portion of the substrate core;

an integrated circuit having a top surface and a backside surface, the integrated circuit mounted to the buildup layer with the top surface of the integrated circuit facing the package substrate; and

a heat spreader mounted to the second portion of the substrate core, a bottom surface of the heat spreader thermally coupled to the backside surface of the integrated circuit.

11. (Original) The apparatus of claim 10, wherein the heat spreader is thermally coupled to a perimeter portion of the substrate core.

12. (Original) The apparatus of claim 10, wherein the heat spreader is soldered to the substrate core.
13. (Previously presented) The apparatus of claim 10, wherein the substrate core and the heat spreader are electrically conductive and electrically connected, the substrate core and the heat spreader jointly forming an electrically conductive enclosure to shield the integrated circuit from electromagnetic interference.
14. (Previously presented) The apparatus of claim 13, wherein the substrate core and the heat spreader are made of metal.
15. (Original) The apparatus of claim 10, comprising a thermal interface material disposed between the backside surface of the integrated circuit and the bottom surface of the heat spreader.
16. (Original) The apparatus of claim 10, comprising a heat sink attached to a top surface of the heat spreader.
17. (Original) The apparatus of claim 16, comprising a fan attached to the heat sink.

18. (Original) The apparatus of claim 10, wherein the integrated circuit is mechanically and electrically coupled to the package substrate by a plurality of solder bump interconnections.
19. (Original) The apparatus of claim 18, comprising a printed circuit board, wherein the package substrate is mounted on the printed circuit board.
20. (Original) The apparatus of claim 19, wherein the package substrate is mechanically and electrically coupled to the printed circuit board by a plurality of solder bump interconnections.
21. (Previously presented) An apparatus comprising:
- a package substrate including a thermally conductive substrate core, having first and second portions, and a buildup layer, including a plurality of conductive traces and vias formed therein interconnecting top and bottom surfaces of the buildup layer, being disposed on only the first portion of the substrate core;
 - at least two integrated circuits having top surfaces and a backside surface, the integrated circuits mounted to the package substrate with the top surfaces of the integrated circuits facing the package substrate; and
 - a heat spreader mounted to the second portion of the substrate core, wherein a surface of the heat spreader is thermally connected to the backside surfaces of the at least two integrated circuits.

22. (Original) The apparatus of claim 21, comprising one or more capacitors mounted on a top surface of the package substrate.

23. (Previously presented) The apparatus of claim 21, wherein the substrate core and the heat spreader are electrically conductive and electrically connected, the substrate core and the heat spreader jointly forming an electrically conductive enclosure to shield the integrated circuits from electromagnetic interference.

24. (Previously presented) An apparatus comprising:

a package substrate including a metal substrate core, having first and second portions, and a buildup layer, having a plurality of conductive traces and vias formed therein interconnecting top and bottom surfaces of the buildup layer disposed on the first portion of the substrate core;

an integrated circuit having a top surface and a backside surface, the integrated circuit mounted to the buildup layer with the top surface of the integrated circuit facing the package substrate; and

a heat spreader mounted to the second portion of the substrate core, a bottom surface of the heat spreader thermally coupled to the backside surface of the integrated circuit.

25. (Previously presented) The apparatus of claim 24, wherein the heat spreader is thermally coupled to a perimeter portion of the substrate core.

26. (Previously presented) The apparatus of claim 25, comprising a heat sink attached to a top surface of the heat spreader.

27. (Previously presented) The apparatus of claim 24, wherein the heat spreader is metal and is electrically connected to the substrate core.

28. (Previously presented) The apparatus of claim 27, wherein the heat spreader and the substrate core jointly form an electrically conductive enclosure to shield the integrated circuit from electromagnetic interference.

29. (New) An apparatus comprising:

a printed circuit board;

a package substrate mounted to the printed circuit board, the package substrate including a thermally conductive substrate core, having first and second portions, and a buildup layer, including a plurality of conductive traces and vias formed therein interconnecting top and bottom surfaces of the package substrate layer, being disposed on only the first portion of the substrate core;

an integrated circuit having a top surface and a backside surface, the integrated circuit mounted to the buildup layer with the top surface of the integrated circuit facing the package substrate, the integrated circuit being electrically connected to the printed circuit board through the conductive traces and vias of the package substrate; and

a heat spreader mounted to the second portion of the substrate core, a bottom surface of the heat spreader thermally coupled to the backside surface of the integrated circuit.

30. (New) The apparatus of claim 29, wherein the heat spreader is thermally coupled to a perimeter portion of the substrate core.

31. (New) The apparatus of claim 30, wherein the heat spreader is soldered to the substrate core.

32. (New) The apparatus of claim 31, wherein the substrate core and the heat spreader are electrically conductive and electrically connected, the substrate core and the heat spreader jointly forming an electrically conductive enclosure to shield the integrated circuit from electromagnetic interference.